1. Find two sets $A$ and $B$ such that $A \in B$ and $A \subseteq B$.

2. Give the following sets, if $A = \{1, 2, (x, y)\}$, $B = \{b, c, \{2, 3\}\}$, and $C = \{1, a, (1, b), (2, c), (x, y)\}$. (Recall that $\mathcal{P}(X)$ is the power set of $X$.)
   (a) $\mathcal{P}(B)$
   (b) $A \times B - C$
   (c) $\mathcal{P}(\emptyset) \times (A \cap C)$

3. Prove or disprove the following:
   (a) $A \times (B \cup C) = (A \times B) \cap (A \times C)$
   (b) $(A - C) \cap (C - B) = \emptyset$
   (c) If $\mathcal{P}(A) = \mathcal{P}(B)$, then $A = B$.
   (d) If $A \cap C = B \cap C$, then $A = B$.

4. (a) Prove that for any two sets $A$ and $B$, $\mathcal{P}(A) \cup \mathcal{P}(B) \subseteq \mathcal{P}(A \cup B)$.
   (b) Give a counterexample for the following statement: if $A$ and $B$ are sets, then $\mathcal{P}(A) \cup \mathcal{P}(B) = \mathcal{P}(A \cup B)$. 